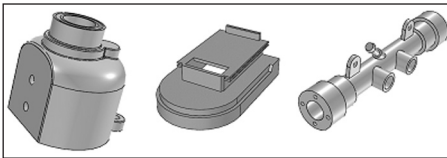
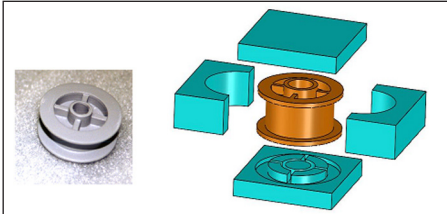


RESEARCH BRIEF

NEXT-GENERATION MOLDING TECHNOLOGIES



Top, a permanent multi-piece mold and its resulting part. Beneath, a few examples of parts that can be made with these molds.

The challenge

Traditional molding technologies can handle a limited class of shapes. This restriction constrains the design space.

Solution 1: Injection molding using permanent multi-piece molds

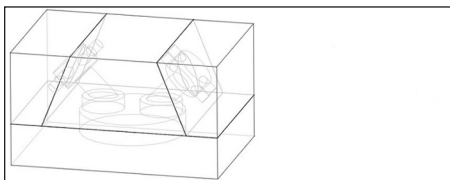
These molds enable the manufacture of geometrically complex objects, which are impossible to make using traditional two-piece molds.

Potential uses: automobile parts and consumer appliance housings.

Research progress: We are developing design for manufacturing guidelines for parts being produced using space puzzle molds. The guidelines specify draft angles, section dimensions, and tolerances to be used in multi-piece molding.

We are developing geometric reasoning algorithms for automated design of multi-piece permanent molds.

Solution 2: Low-temperature molding using sacrificial multi-piece molds



A sacrificial multi-piece mold and its resulting part.

This process enables the manufacturing of geometrically complex objects, which are impossible to make using permanent molding processes

because of demolding problems.

Potential uses: Gelcasting of complex ceramic parts in the ceramic industry

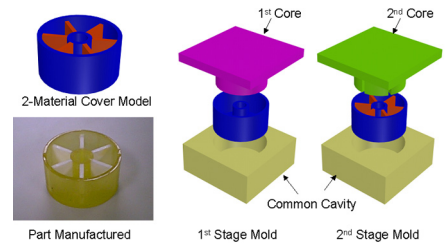
Research progress: We are developing a molding process that combines CNC machining, layered fabrication, and injection molding for mold fabrication. This molding process enables molding of large objects with very small features.

We are developing geometric reasoning algorithms for automated design of multi-piece sacrificial molds.

Solution 3: Multi-stage molds for producing multi-material objects

This process enables the manufacturing of multi-material objects. Differences in compliance, color, and hardness can be utilized to create products with superior performance. The in-mold assembly means no assembly operations are needed afterwards.

Potential users and uses: The automobile industry, the furniture industry, the toy industry and consumer products.



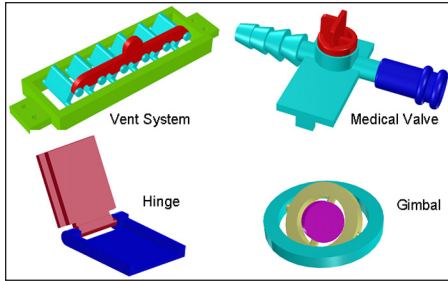
A multi-stage mold and its resulting part.

Research progress: ISR researchers are developing a new multi-stage molding process for providing geometrically complex interfaces. Our process supports chemical, macroscopic, and mesoscopic interfaces as well as articulated assemblies.

We are developing geometric reasoning algorithms for automated design of multi-stage molds.

Awards

Dr. Gupta won a Presidential Early Career Award for Scientists and Engineers (PECASE) for his related work on developing the new molding process and decision support tool that make it possible to manufacture multi-material parts in a cost-effective manner. This research allows designers to select different materials for different portions of the part, creating new product possibilities that never existed before. Some examples are helicopter rotors with



Examples of parts that can be made using multi-stage molds.

adaptive geometries, snap fits with superior fatigue-life, and hermetically-sealed sensor housings.

The PECASE is the highest honor given by the U.S. government to outstanding scientists and engineers in the early stages of establishing their research careers. Only 20 NSF-supported PECASE awards are given out each year.

Research team

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